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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/676,727	09/29/2000	Francis X. Canning	CANNING.001A	2872

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EXAMINER	
ROSALES HANNER, MORELLA I	
ART UNIT	**PAPER NUMBER**
2128	

DATE MAILED: 08/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/676,727	CANNING, FRANCIS X.	
	Examiner	Art Unit	
	Morella I Rosales-Hanner	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on *29 September 0200* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: Requirement for Information under 37 C.F.R. 105.

Requirement for Information Under 37 C.F.R. § 1.105

1. Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information, which the examiner has determined, is reasonably necessary to the examination of this application:

- Detailed description of the SuperNEC software features up to Jan 10th 2000 (this includes user's manual, reference guides and earlier versions of the product),
- Detailed description and date of first available to the public of all versions of the SuperNEC product that incorporate the LU Sparse Integral FactorEd Representation (LUSIFER) method.
- Detailed description of Mr. Kevin' Rogovin's contribution to the "Fast Direct Solution of Standard Moment-Method" article since this article appears to anticipate the claimed invention.

It is noted that the specification recites [Pg 21, lines 17-22] the following:

> "... *One embodiment of the composite source compression technique is used in connection with the computer program NEC2...*"

Also, a printed publication from Mobile/Cellular Technology discloses [fourth paragraph] release 2.5 of the SuperNEC software product, which incorporates the

"Simply Sparse" solver core and other methods by the Applicant, Dr. Francis Canning.

The information is required because it is essential matter in the disclosed subject matter of a method for optimizing the computer resources to solve large problems in a shorter time frame and identifies the properties of similar products and methods found in the prior art. These disclosures are material to the patentability of the claims.

In response to this requirement, please provide the citation and a copy of each publication that the applicant relied upon to draft the claimed subject matter. For each publication, please provide a concise explanation of the reliance placed on the publication in distinguishing the claimed subject matter from the prior art.

In responding to those requirements that require copies of documents, where the document is a bound text or a single article over 50 pages, the requirement may be met by providing copies of those pages that provide the particular subject matter indicated in the requirement, or where such subject matter is not indicated, the subject matter found in applicant's disclosure.

The fees and certification requirements of 37 C.F.R. § 1.97 are waived for those documents submitted in reply to this requirement. This waiver extends only to those documents within the scope of this requirement under 37 C.F.R. §

1.105 that are included in the applicant's first complete communication responding to this requirement. Any supplemental replies subsequent to the first communication responding to this requirement and any information disclosures beyond the scope of this requirement under 37 C.F.R. § 1.105 are subject to the fee and certification requirements of 37 C.F.R. § 1.97.

The applicant is reminded that the reply to this requirement must be made with candor and good faith under 37 CFR 1.56. Where the applicant does not have or cannot readily obtain an item of required information, a statement that the item is unknown or cannot be readily obtained will be accepted as a complete response to the requirement for that item.

This requirement is an attachment of the enclosed Office action. A complete response to the enclosed Office action must include a complete response to this requirement. The time period for reply to this requirement coincides with the time period for reply to the enclosed Office action, which is **THREE (3) months**.

MRH

Aug 2nd 2004

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER

Detailed Action

1. **Claims 1 – 33** have been examined and are pending.

Priority

2. The Office acknowledges Applicant's claim for domestic priority under 35 U.S.C. 119(e) from U.S Provisional Application No. 60/175,454, filed on Jan. 10th, 2000 and from U.S. Provisional Application No. 60/201,149, filed on May 2nd, 2000. However, the provisional applications upon which priority is claimed fail to provide adequate support under 35 U.S.C. 112 for **claims 1- 22, and 28 - 33** of this application. There is lack of support in the specification of the Provisional applications for the Method of Moments (MoM) for the use of basis and weighting functions as well as far-field disturbances.

Information Disclosure Statement

3. The information disclosure statements (IDS) received by the Office on Jan10th, May 21st and Jun 26th of 2001, are in compliance with the provisions of 37 CFR 1.97. Accordingly, the Examiner has considered the information disclosure statements.

Drawings

4. **Figures 1A – 1C** should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because it lacks a statement regarding federally sponsored research and development. Correction is required. See MPEP §310.

Oath/Declaration

5. A new oath or declaration is required because an article ("Fast Direct Solution of Standard Moment-Method Matrices") authored by the Applicant and Mr. **Kevin Rogovin** appears to teach the claim invention appears to suggest that Mr. Rogovin's name is missing from declaration. The wording of an oath or declaration cannot be amended. If the wording is not correct or if all of the required affirmations have not been made or if it has not been properly subscribed to, a new oath or declaration is required. The new oath or declaration must properly identify the application of which it is to form a part,

preferably by application number and filing date in the body of the oath or declaration. See MPEP §§ 602.01 and 602.02.

Claim Rejections - 35 USC § 112

87. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7.1 **Claim 12** recites the limitation "***basis composite sources***" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8.1 **Independent claims 1, 2, 10, 23, 27 and 28** are rejected under 35 U.S.C. 101 because as written, it is unclear whether the steps are intended to be performed using a computer, with the calculations and transformations occurring therein. It appears that the claims currently encompass a series of mental steps and are directed to a technique, per se. Claims 3 – 9, 11 – 22, 24-26 and 29 – 33 are also rejected under 35 U.S.C. 101 because they depend on one of the rejected independent claims.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9.1 **Claims 1- 33** are rejected under 35 U.S.C. 102(b) as being clearly anticipated by a printed publication from the Rockwell Science Center by Francis X. Canning and Kevin Rogovin titled "***Fast Direct Solution of Standard Moment-Method Matrices***", hereafter referred to as *Rockwell*.

9.1.1 As regard to **Claim 1**, *Rockwell* teaches **[Pg 15, right Col – Pg 16, left Col]** a method of storing a matrix in sparse format (compress), comprising:

- partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an source point (original source);

- selecting a plurality of spherical angles;

- calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of transmitted disturbances;

- reducing a rank of said matrix of transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions;

- partitioning a first set of weighting functions into groups, each group corresponding to one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester;

- calculating a far-field disturbance received by each of said testers in a first group for each of said spherical angles to produce a matrix of received disturbances;

- reducing a rank of said matrix of received disturbances to yield a second set of weighting functions, said second set of weighting functions corresponding to composite testers, each of said

composite testers comprising a linear combination of one or more of said original testers; **and**

- transforming said system of linear equations to use said composite sources and said composite testers.

9.1.2 As regard to **Claim 2**, *Rockwell* teaches **[Pg 15, right Col – Pg 16, left Col]** a method of storing a matrix in sparse format (compress), comprising:

- partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to an unknown in a system of equations, each of said basis functions corresponding to an original source;
- selecting a first plurality of angular directions;
- calculating a disturbance produced by each of said basis functions in a first group for each of said angular directions to produce a matrix of disturbances;
- using said matrix of disturbances to compute a second set of basis functions, said second set of basis functions corresponding to composite sources, wherein at least one of said composite sources produces a relatively weak disturbance from a portion of space around said at least one composite source;

- partitioning a first set of weighting functions into groups, each group corresponding one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester;
- calculating a disturbance received by each of said testers in a second plurality of angular directions to produce a matrix of received disturbances;
- using said matrix of received disturbances to compute a second set of weighting functions, said second set of weighting functions corresponding to composite testers, wherein at least one of said composite testers weakly receives disturbances from a portion of space relative to said at least one composite tester; **and**
- transforming at least a portion of said system of equations to use one or more of said composite sources and one or more of said composite testers.

9.1.3 As regard to **Claim 3**, *Rockwell* teaches **[Pg 15, right Col]** that the matrix of disturbances of claim 2 is a moment method matrix.

9.1.4 As regard to **Claim 4**, *Rockwell* teaches **[Pg 15, right Col]** the step of using a matrix of disturbances to compute a second set of basis functions that comprises reducing a rank of said matrix of disturbances.

9.1.5 As regard to **Claim 5**, *Rockwell* teaches **[Pg 15, right Col]** the step of using matrix of received disturbances to compute a second set of weighting functions comprises reducing a rank of said matrix of received disturbances.

9.1.6 As regard to **Claim 6**, *Rockwell* teaches **[Pg 15, left Col, last paragraph]** the method of Claim 2, wherein said disturbance is **at least one of** an electromagnetic field, a heat flux, an electric field, a magnetic field, a vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, a strong nuclear force, and a gravity force.

9.1.7 As regard to **Claim 7**, *Rockwell* teaches **[Pg 15, right Col]** that the first plurality of directions is substantially the same as the second plurality of directions.

9.1.8 As regard to **Claim 8**, *Rockwell* teaches **[Pg 15, right Col]** that the regions of space around at least one composite source are far-field regions.

9.1.9 As regard to **Claim 9**, *Rockwell* teaches **[Pg 16, left Col]** at least a portion of a region around at least one composite tester is a far-field region.

9.1.10 As regard to **Claim 10**, *Rockwell* teaches **[Pg 15, right Col - Pg 16, left Col]** a method of storing a matrix in sparse format (compress), comprising:

- calculating one or more composite sources as a linear combination of one or more basis functions, wherein at least one of said composite sources produces a relatively weak disturbance in a portion of space related to said at least one composite source;
- calculating one or more composite testers as a linear combination of one or more weighting functions, wherein at least one of said composite testers is affected relatively weakly by disturbances propagating from a portion of space around said at least one composite tester; **and**
- transforming at least a portion of a first system of equations based on said basis functions and said weighting functions into a second system of equations based on said composite sources and said composite testers.

9.1.11 As regard to **Claim 11**, *Rockwell* teaches **[Pg 15, left Col, last paragraph]** the method of Claim 10, wherein said disturbance **is at least one of**, an electromagnetic field, a heat flux, an electric field, a magnetic field, vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, strong nuclear force, and a gravity force.

9.1.12 As regard to **Claims 12 – 16**, *Rockwell* teaches **[Pg 15, left Col, last paragraph]** a method that applies not only to antenna and propagation problems, but also to all electromagnetic problems (e.g., electromagnetic interference), Method of

Moments problems (e.g., electrostatic and vectorial) as well as to matrices coming from nearly all integral-equation formulations (e.g., Nystrom's method), Helmholtz equations, Laplace's equations and to other linear wave phenomena.

9.1.13 As regard to **Claim 17**, *Rockwell* teaches **[Pg 15, right Col]** composite sources corresponding to a region.

9.1.14 As regard to **Claim 18**, *Rockwell* teaches **[Pg 16, left Col, 1st full paragraph]** a second system of equations that is described by a sparse block diagonal matrix.

9.1.15 As regard to **Claim 19**, *Rockwell* teaches **[Pg 16, left Col, 2nd full paragraph]** the step of reordering the sparse block diagonal matrix to shift relatively larger entries in the matrix towards a desired corner of the matrix.

9.1.16 As regard to **Claim 20**, *Rockwell* teaches **[Pg 16, left Col]** the step of solving a second system of equations.

9.1.17 As regard to **Claim 21**, *Rockwell* teaches **[Pg 18, left Col]** the step of solving a second system of equations to produce a first solution vector, wherein the first solution vector are expressed in terms of the composite testers.

9.1.18 As regard to **Claim 22**, *Rockwell* teaches **[Sections 7.1 – 7.4]** the step of transforming a first solution vector into a second solution vector, wherein the second solution vector is expressed in terms of the weighting functions.

9.1.19 As regard to **Claim 23**, *Rockwell* teaches **[Pgs 18 – 19, Section 4]** a method comprising:

- calculating at least one composite source, said composite source representing energy sources;
- calculating at least one composite tester; **and**
- transforming at least a portion of a first system of linear equations into a second system of linear equations leased at least on said at least one composite source and said at least one composite tester.

9.1.20 As regard to **Claim 24**, *Rockwell* teaches **[Section 4]** that at least one composite source represents a linear combination of one or more energy sources such that the at least one composite source radiates relatively little energy into a portion of angular region disposed about the at least one source.

9.1.21 As regard to **Claim 25**, *Rockwell* teaches **[Pg 19, Section 4, last paragraph]** that at least one composite tester is affected relatively weakly by energy propagating from a portion of space around at least one composite tester.

9.1.22 As regard to **Claim 26**, *Rockwell* teaches **[Pg 18, right Col, 2nd full paragraph]** a second system of linear equations that is represented by a block sparse matrix.

9.1.23 As regard to **Claim 27**, *Rockwell* teaches **[Section 8]** an apparatus comprising:

- means for calculating at least one composite source;
- means for calculating at least one composite tester; **and**
- means for transforming at least a portion of a first system of equations into a second system of equations based at least on said at least one composite source and said at least one composite tester.

9.1.24 As regard to **Claim 28**, *Rockwell* teaches **[Pg 15, right Col – Pg 16, left Col]** a method of storing a matrix in sparse format (compress), comprising:

- calculating one or more composite sources as a combination of one or more basis functions, wherein at least one of said composite sources produces a relatively weak product in a portion of space;
- calculating one or more composite testers as a combination of one or more weighting functions, wherein at least one of said composite testers interacts relatively weakly with said at least one composite tester; **and**

- transforming at least a portion of a first array of interaction data based on said basis functions and said weighting functions into a second array of interaction data based on said composite sources and said composite testers.

9.1.25 As regard to **Claim 29**, *Rockwell* teaches [**Pg 15, left Col, last paragraph**] the method of Claim 28, wherein said disturbance **is at least one of**, an electromagnetic field, a heat flux, an electric field, a magnetic field, vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, strong nuclear force, a gravity force, and an image element.

9.1.26 As regard to **Claim 30**, *Rockwell* teaches [**Pg 15, right Col**] composite sources corresponding to a region.

9.1.27 As regard to **Claim 31**, *Rockwell* teaches [**Pg 16, left Col, 1st full paragraph**] a second array of interaction data that is described by a sparse block diagonal matrix.

9.1.28 As regard to **Claim 32**, *Rockwell* teaches [**Pg 18, left Col**] the step of using a second matrix (array) of interaction data to compute a first solution vector, wherein the first solution vector is expressed in terms of composite testers.

9.1.29 As regard to **Claim 33**, *Rockwell* teaches **[Sections 7.1 – 7.4]** the step of transforming a first solution vector into a second solution vector, wherein the second solution vector is expressed in terms of said weighting functions.

Additional references

10. This Office action has an attached requirement for information under ***37 C.F.R. § 1.105***. A complete response to this Office action must include a complete response to the attached requirement information. The time for reply to the attached requirement coincides with the time period for reply to this Office action.

11. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- D.C. Nitch and A.P.C. Fourie; "A Redesign of NEC2 Using Object-Oriented Paradigm"; 1994; IEEE
- Massachusetts Institute of Technology; "The Method of Moments in Electromagnetics 6.635 lecture notes"
- Andre Fourie and Derek Nitch; "SuperNEC: Antenna and Indoor-Propagation Simulation Program"; Poynting Software (Pty) Ltd; June 2000
- D.C. Nitch and A.P.C. Fourie; "Investigating three methods for improving the Performance of the SIM Algorithm"; 1994; IEEE

- James C. West and J. Michael Sturm; "On Iterative Approaches for Electromagnetic Rough-Surface Scattering Problems"; Aug. 1999; IEEE transactions on Antennas and Propagation, Vol. 47, No. 8
- A.P.C. Fourie and D.C. Nitch; " A fast Sparse Iterative Method (SIM) for Method of Moment"; 1994; IEEE
- W.C. Chew, J.M. Jin, C.C. Lu, E. Michielssen, J.M. Song; "Fast Solution Methods in Electromagnetics"; Mar. 1997; IEEE transactions on Antennas and Propagation; Vol. 45 No. 3 pp. 533-543
- Francis X. Canning; "A Sparse Approximate Inverse to the IML Matrices Allows Solution in 5 Iterations", 1992, IEEE
- Mobile/Cellular Technology website (http://www.mobilecomms-technology.com/contractors/antennas/poynting/press2.html) Oct 2003

12. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Morella Rosales-Hanner whose telephone number is (703) 305-8883. The examiner can normally be reached Monday-Friday from 7:00 a.m. to 3:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jean Homere can be reached on (703) 308-6647. The fax number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

MRH

August 2nd, 2004

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER